

### **ABSTRACT OF THE DISCLOSURE**

The present invention presents a new approach to rapidly obtaining precise high-dimensional NMR spectral information, named “GFT NMR spectroscopy”, which is based on the phase sensitive joint sampling of the indirect dimensions spanning a subspace of a conventional NMR experiment. The phase-sensitive joint sampling of several indirect dimensions of a high-dimensional NMR experiment leads to largely reduced minimum measurement times when compared to FT NMR. This allows one to avoid the “sampling limited” data collection regime. Concomitantly, the analysis of the resulting chemical shift multiplets, which are edited by the G-matrix transformation, yields increased precision for the measurement of the chemical shifts. Additionally, methods of conducting specific GFT NMR experiments as well as methods of conducting a combination of GFT NMR experiments for rapidly obtaining precise chemical shift assignment and determining the structure of proteins or other molecules are disclosed.